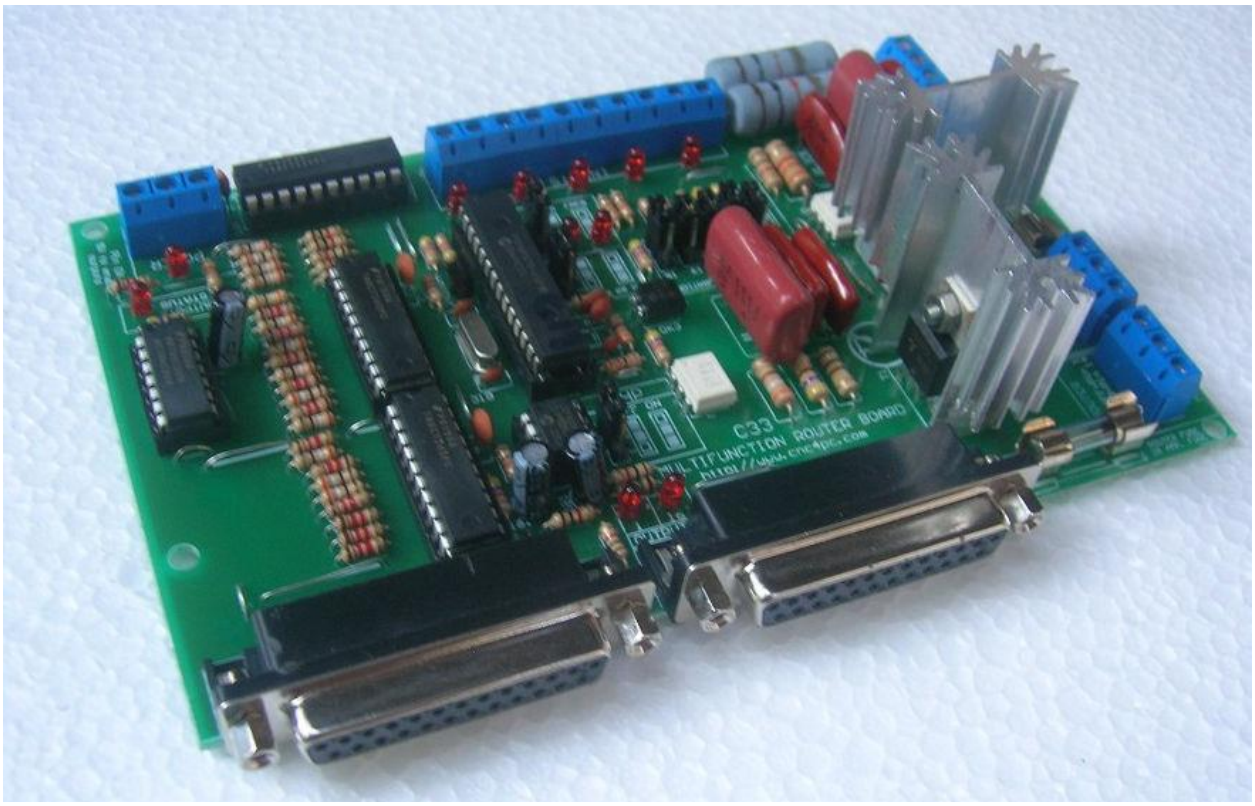
CNC4PC

Integration Solutions for CNC Projects

USER'S MANUAL

C33 - MULTIFUNCTION ROUTER BOARD
BOARD Rev 2.4



FEBRUARY, 2015

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TABLE OF CONTENTS
Page #

Contents

1.0 OVERVIEW 1
2.0 FEATURES 1
3.0 SPECIFICATIONS 2
4.0 BOARD DESCRIPTION 3
5.0 SELECTION JUMPER 4
5.1 Jumper for Input (PULL-UP or PULL-DOWN) 4
5.2 Jumper for (PWM or FREQ) 4
5.3 Jumper for Frequency (50Hz or 60Hz) 5
6.0 SPECIAL FUNCTIONS 5
6.1 Safety Charge Pump "SCHP". (Pin 17) 5
6.2 Selecting the SCHP operation mode 6
6.3 Configuring the Control Software: 7
7.0 ENABLE PIN 9
8.0 WIRING SAMPLE 10
9.0 FUNCTIONAL BLOCK DIAGRAMS 11
9.1 Pins 2-9 simplified block diagram 11
9.2 Pins 1, 14, 16 and 17 simplified block diagram 11
9.3 Inputs simplified block diagram 12
10.0 WIRING DIAGRAMS 13
10.1 Connecting Switches or push button 13
10.2 Connecting NPN sensors. 13
10.3 Connecting PNP sensors. 16
10.4 Other connection. 16
11.0 TROUBLESHOOTING 17
12.0 DIMENSIONS 20

1.0 OVERVIEW

This card provides an easy way of interfacing your router based spindle with your steeper motor driver board. This board includes a speed controller for routers. Additionally provides terminals for inputs to be used as are required by the user.

2.0 FEATURES

- **IEEE 1284 Standard compatible.** Includes the circuitry recommended by the IEEE 1284 Level 1 standards for bidirectional parallel communications between personal computers and peripherals.
- **DB25 connector to connect the stepper motor driver board.** These connectors manage only pins 2 – 9.
- **Microcontroller based SCHP.** This board comes with a microcontroller that allows the implementation of a complex algorithm for sampling and analyzing the SCHP signal.
- **Terminals to control the router speed.**
- **Additional Terminals for controlling a coolant pump or vacuum.**
- **Speed Control Signal Can Be PWM or 0-25HZ Pulse Stream.**
- **Works with 110 or 220VAC at 60 or 50 HZ.**
- **For 2.5HP or 1800 Watt Routers.**
- **LEDs Show The Operation Mode.**
- **Buffered inputs and outputs.** Outputs are buffered through the use of high speed and high current buffers allowing the card to output the signals without using the power from the parallel port. It can take the +3.3 or +5vdc signal from the parallel port and deliver solid +5vdc at 24 milliamps.
- **Input and output pins with close by ground or +5vdc connections**
- **External Enable Pin (EN).** The board has a pin that allows you to enable/disable all the outputs at once. The board requires +5vdc in the EN pin. If it is not present, it will send all the outputs to ground. You can use this to enable or

disable the system manually, or you can install an external Safety Charge Pump or other external safety monitoring device.

- **Works directly with popular CNC hardware and software.** Such as Geckodrive G540, xylotex, HobbyCNC, Rockcliff, or Rutex, and parallel port control software, such as mach2, Linux EMC, TurboCNC, CNCPlayer, CNCZeus and others. (Not all tested).

- **All TTL 5VDC signals.** Interface directly with parallel port interface products and other CNC4PC cards. 5VDC (TTL) cards are very common among automation devices.

- **Screw-On connections for all terminals.** You only have to screw-on the wires to make all your connections.

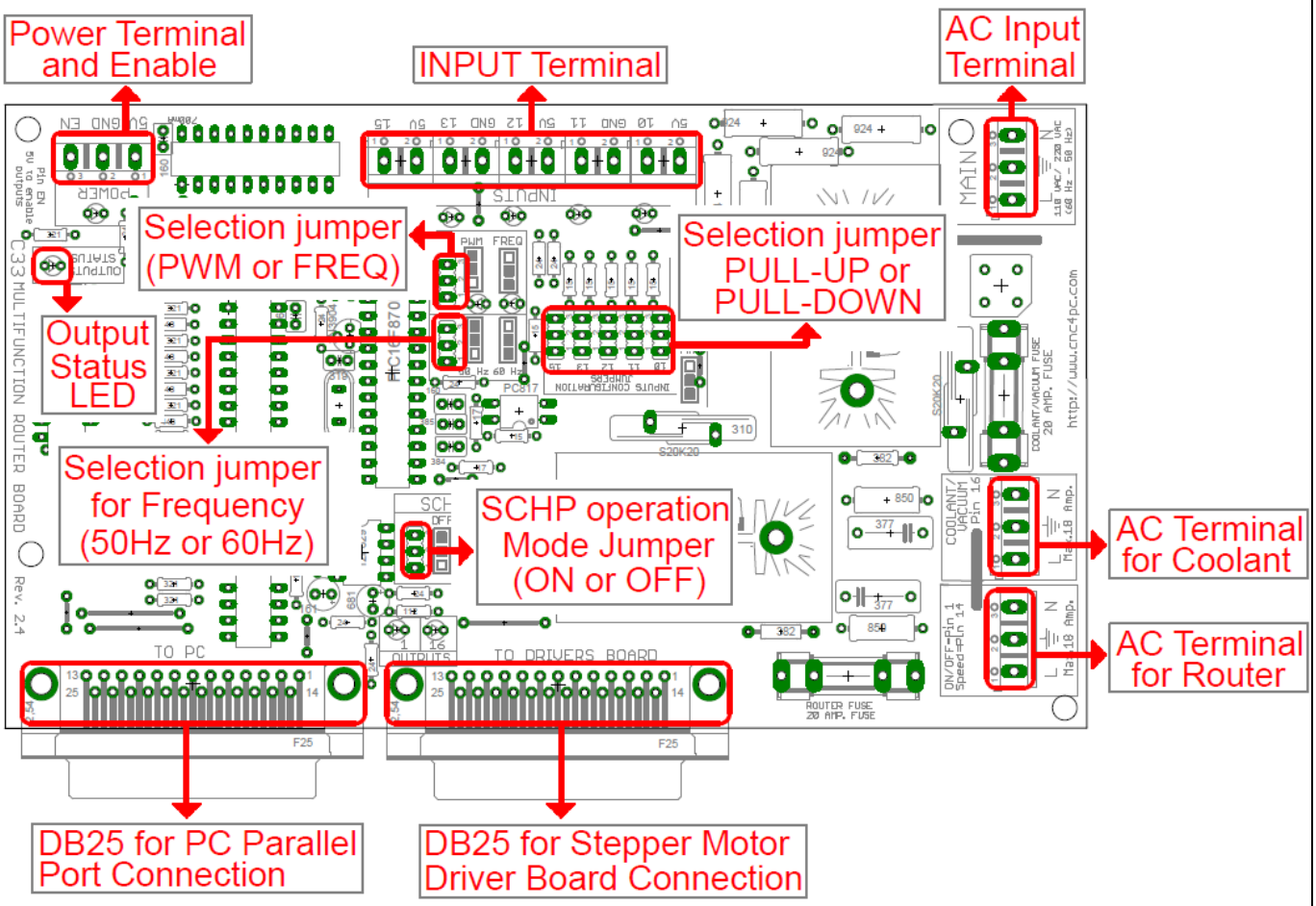
3.0 SPECIFICATIONS

DIGITAL INPUT SPECIFICATIONS	
On-state voltage range	2 to 5V DC
Maximum off-state voltage	0.8V
Maximum operation frequency	4 MHz
Typical signal delay	10nS

DIGITAL OUTPUT SPECIFICATIONS	
Maximum output voltage	(5V power supply voltage) + 0.5V
Typical output current	24mA
Maximum off-state voltage	0.44 V
Maximum operation frequency	4 MHz
Typical signal delay	10 nS
Time of transition to high impedance state	120 mS*

*Time passed since a low in the ENABLE input is detected and the outputs are disabled.

4.0 BOARD DESCRIPTION


Power Terminal and Enable
INPUT Terminal
AC Input Terminal
Selection jumper (PWM or FREQ)
Selection jumper PULL-UP or PULL-DOWN
Output Status LED
Selection jumper for Frequency (50Hz or 60Hz)
SCHP operation Mode Jumper (ON or OFF)
AC Terminal for Coolant
AC Terminal for Router
DB25 for PC Parallel Port Connection
DB25 for Stepper Motor Driver Board Connection

REQUIREMENTS

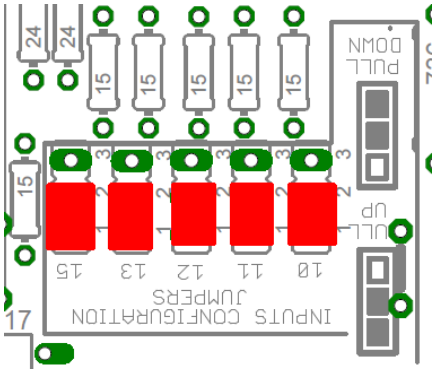
It requires a 5VDC @ 700 milliamps power supply to operate.

5.0 SELECTION JUMPER

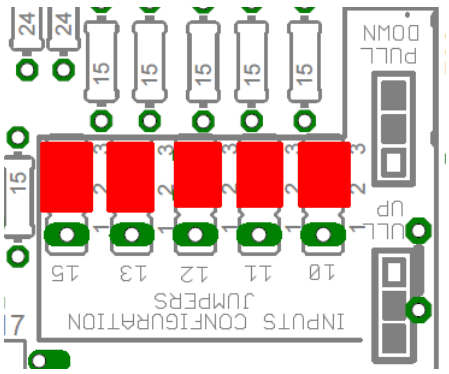
5.1 Jumper for Input (PULL-UP or PULL-DOWN)

Pins 10,11,12,13 and 15 can be set to pull-up or pull-down by selecting the jumper in the appropriate position.
The input pins can be set to be pulled up or down with a 4.7Kohm resistor.

PULL-UP



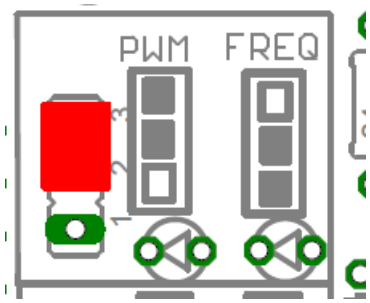
PULL-DOWN



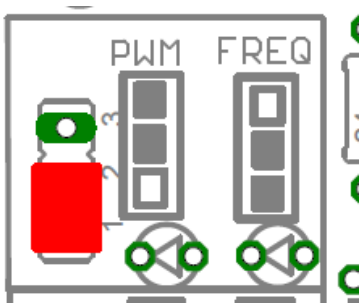
5.2 Jumper for (PWM or FREQ)

Set the jumper to select the appropriate control method, it can be PWM or FREQUENCY. The board can be used with 110 or 220 VAC

PWM



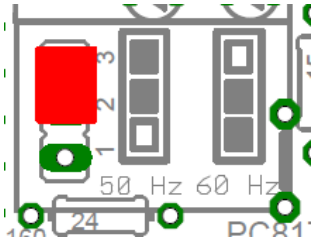
FREQ



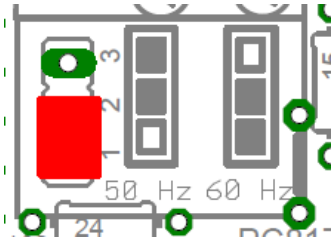
5.3 Jumper for Frequency (50Hz or 60Hz)

Set jumper to the frequency with that it will work

50Hz



60Hz



6.0 SPECIAL FUNCTIONS

6.1 Safety Charge Pump "SCHP". (Pin 17)

This board takes advantage of Mach ability to send a specific frequency through one of the pins of the parallel port when the program is in control of the system. CNC machinery can be very dangerous, and you could have a risk of the machine doing something different that what you intend the machine to do if the program loses control of your system. Mach be can be programmed in a way, so when it is "in control", it delivers a 12.5 KHz signal through one of the pins. This card lets you use this signal to work as an On/Off switch for your system, enabling a powerful safety system for your equipment. If you ever had windows crash on you, then this card is for you. The port can also do weird things while the system is coming up, or down.

For Configuring the *Charge Pump* in *Mach X*: Use the dialog *Config / Ports and pins / Output Signals*. Enable the *Charge Pump* output and configures it as is shown in the Fig. 8 Next, press the *apply* button.

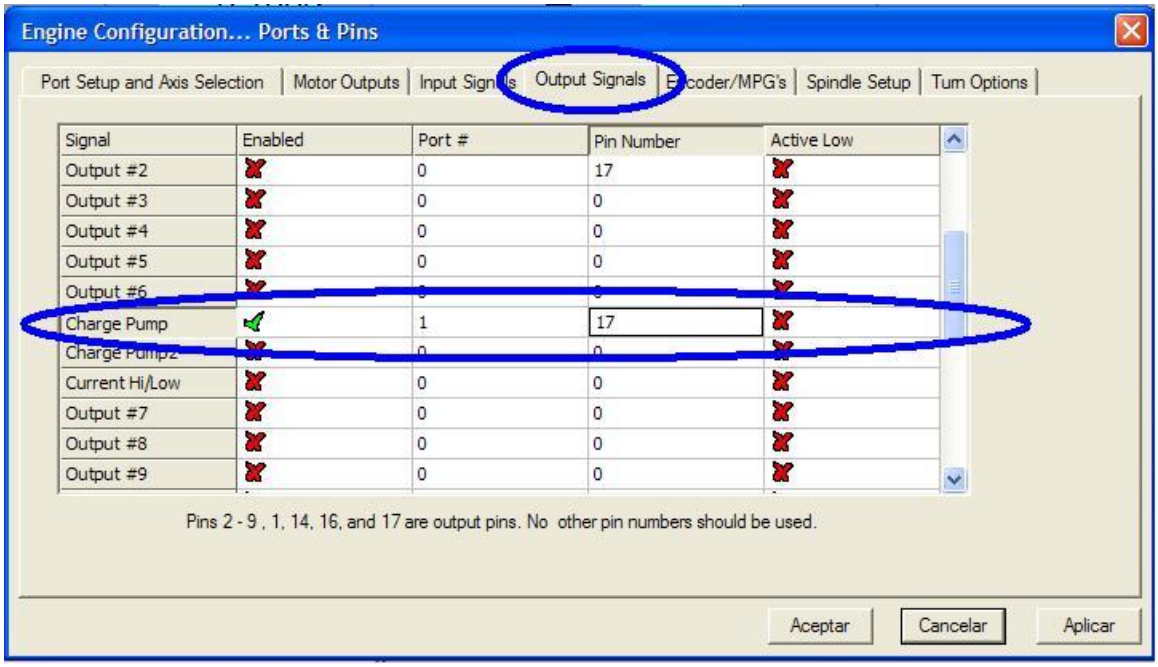
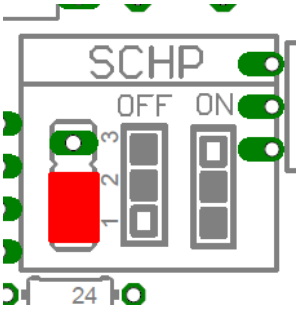


Fig. 4 Charge Pump configuration

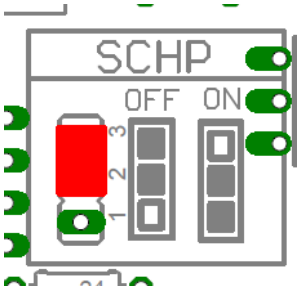
6.2 Selecting the SCHP operation mode

The Safety Charge Pump can be activated or deactivated depending on the jumper position

ON



OFF

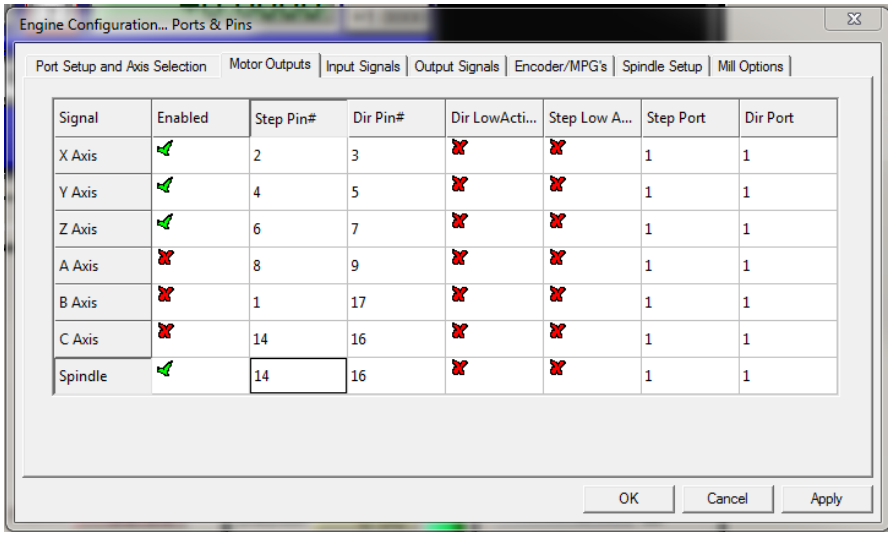


Note: When the Safety Charge Pump is activated, the EN terminal is active and a valid SCHP signal is present, pin 17 will go high. This high signal can be used to enable other external devices, such as enabling other Breakout Boards, or relays that would enable servos, VFDs, contactors, etc….

6.3 Configuring the Control Software:

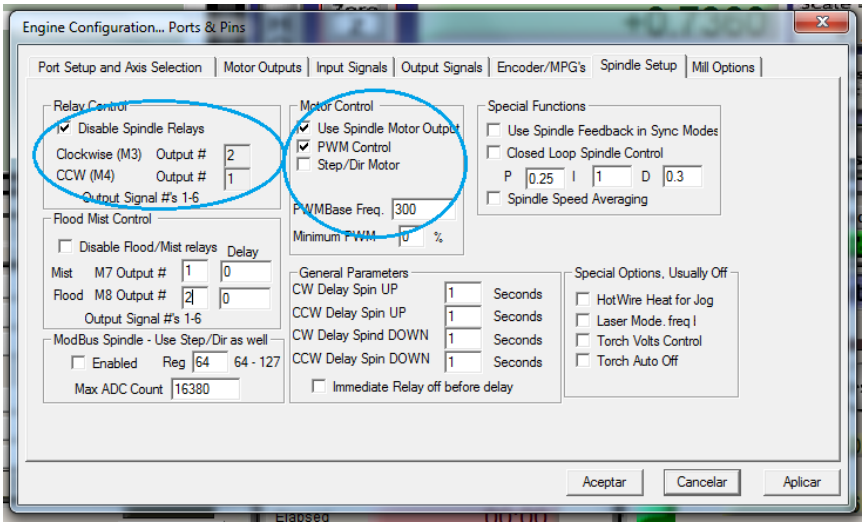
For configuring Mach X follow these steps:

Go to Config / Ports&Pins / Motor Outputs. Enable the spindle and select the port and pins you wired for step and direction.

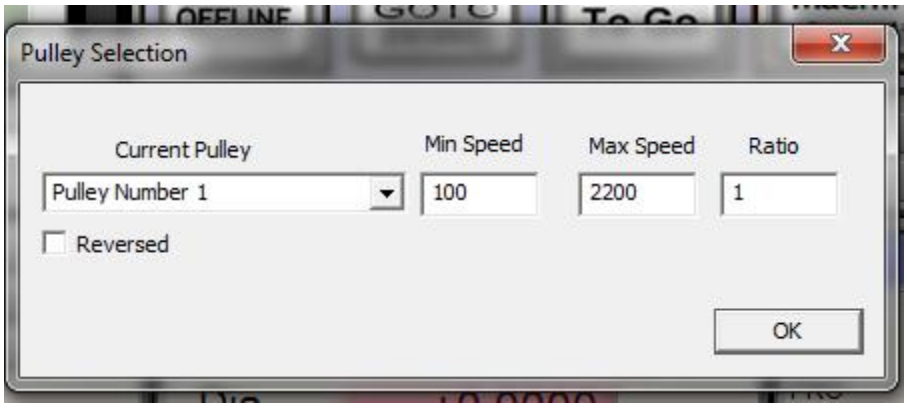


***Ports&Pins* configuration screenshot**

Go to Config / Ports&Pins / Spindle Setup. In the motor control box, check Use Spindle Motor Output and PWM Control with a frequency of 300Hz. If using an external motion controller, like the Smooth Stepper, this needs to be configured in the plugin too.

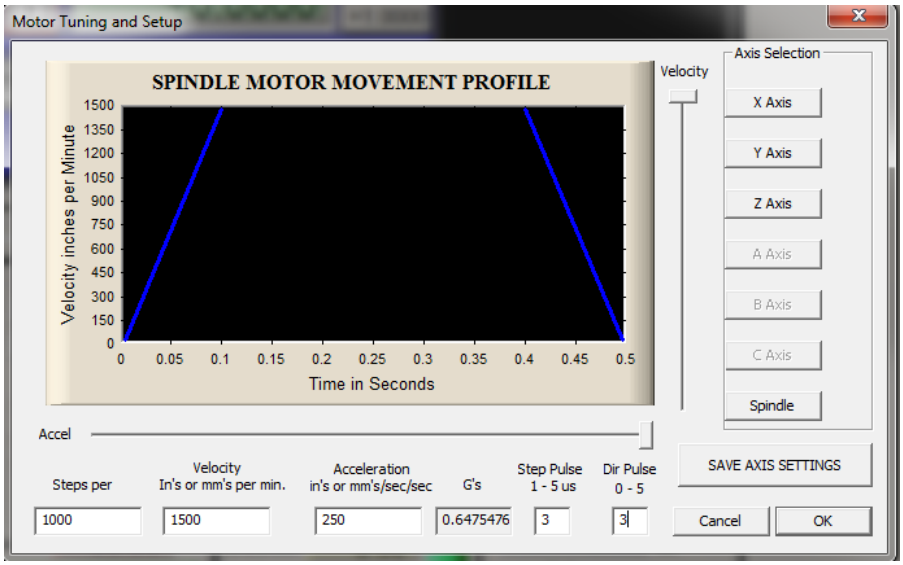


Under Pulley Ratios set the pulley ratios of the machine.



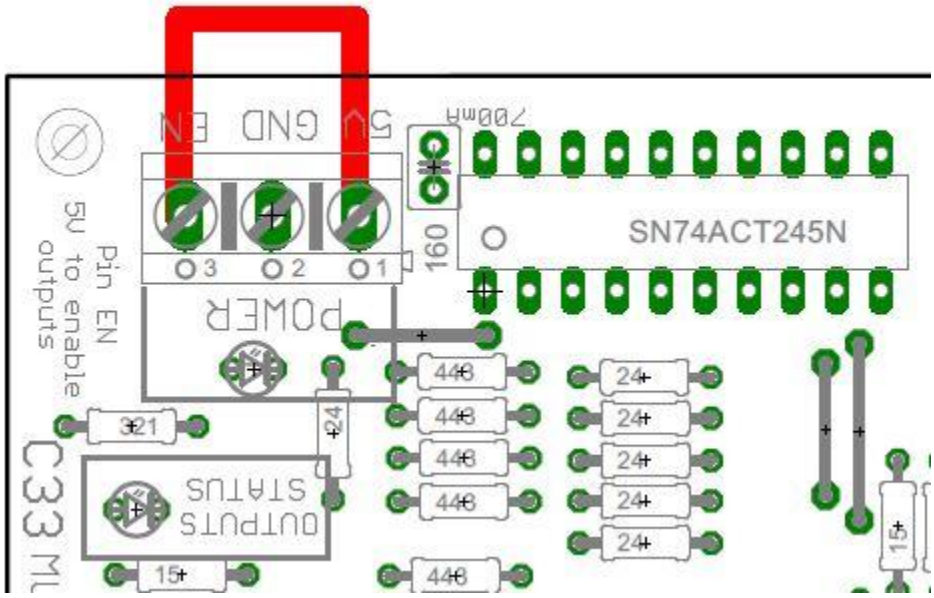
***Spindle Setup* screenshot**

Go to Config / Motor Tuning / Spindle. Set the velocity and acceleration to the max.



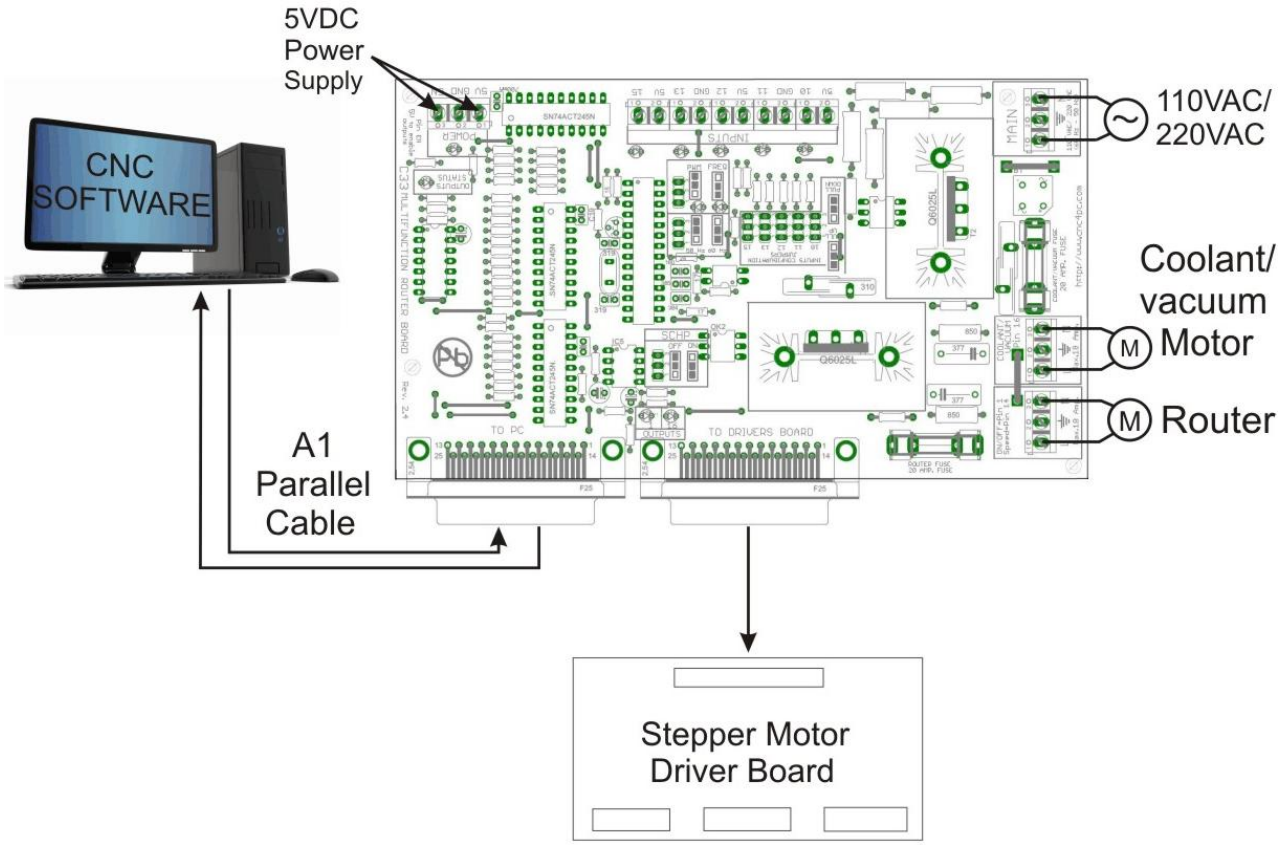
7.0 ENABLE PIN

This is a hardware disable feature. The card must be provided with a 5VDC signal to enable operation. This feature has been added to externally control the status of the outputs. When the enable signal is not present, output signals sent high impedance state. If this function is not required, an jumper can be placed between +5vdc and the EN terminal. It has an internal 4.7kOhm pull-down resistor.



It is always a good idea to wire the EN terminal in parallel with E-Stop, so that when E-Stop is pressed the system is disabled at hardware level, like it is described in this wiring diagram: http://cnc4pc.com/Tech_Docs/E_STOP_N_EN_Wiring.pdf

8.0 WIRING SAMPLE



WARNING: This card must have the power supplied while it is connected to the PC. If power is removed to the card while it is connected to the PC, noise can be introduced to the output lines. This can create a dangerous situation as relays or other devices that might be connected to this card could get activated.

WARNING

Check the polarity and voltage of the external power source and connect the 5V and GND. Overvoltage or reverse-polarity power applied to these terminals can cause damage to the board, and/or the power source. Follow the steps bellow.

9.0 FUNCTIONAL BLOCK DIAGRAMS

9.1 Pins 2-9 simplified block diagram

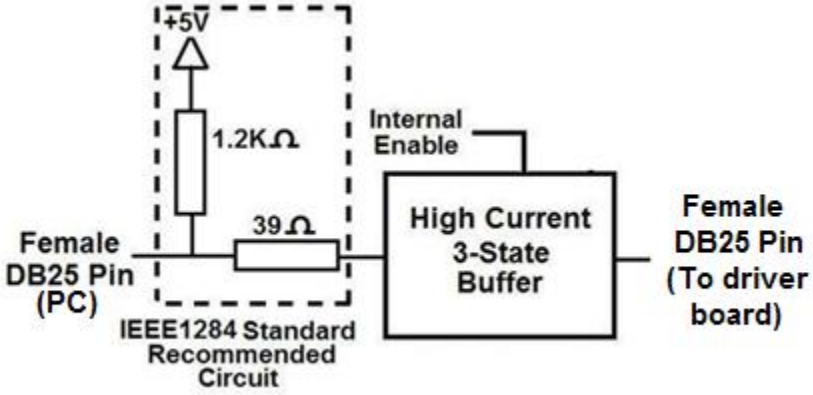


Fig. 1 Simplified functional block diagram for pins 2-9.

9.2 Pins 1, 14, 16 and 17 simplified block diagram

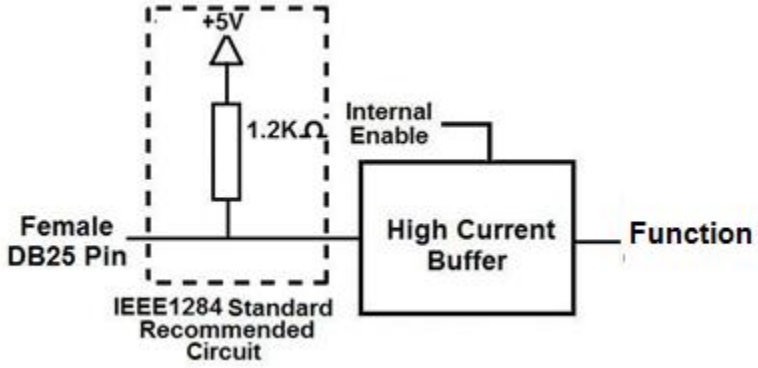


Fig. 2 Simplified functional block diagram for outputs 1, 14, 17 and 16.

Note*: "Internal Enable"* **=** *"External Enable Pin"* **AND (***"SCHP"* **OR** *"Bypassed SCHP"***)**

The "Internal Enable" is the result of an AND Operation between the "External Enable Pin"and the SCHP operation mode selected by the user.

Note: The outputs will be deactivated if the board is not connected to the PC parallel port.

9.3 Inputs simplified block diagram

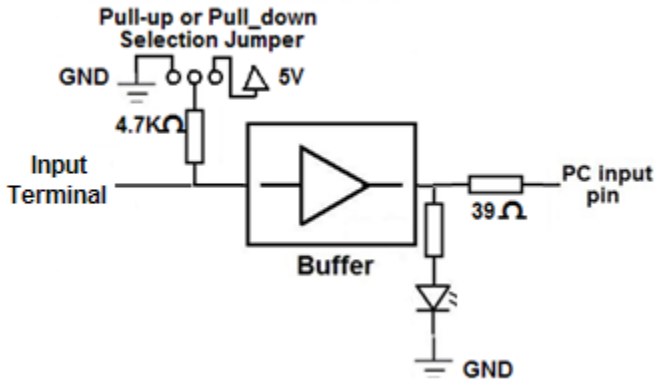
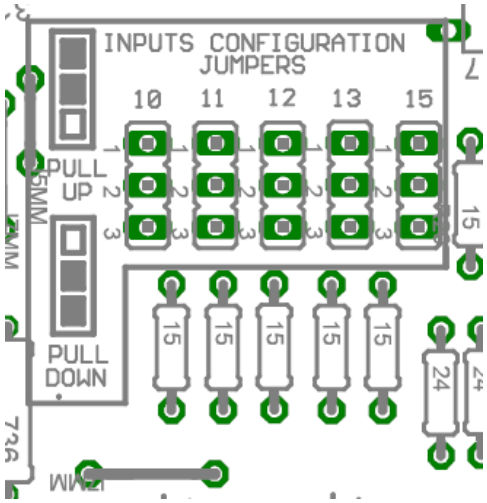


Fig. 3 Simplified functional block diagram for input.

Pins 10, 11, 12, 13 and 15 can be set to pull-down or pull-up by selecting the jumper in the appropriate position.

The input pins can be set to be pulled up or down with a 4.7Kohm resistor.



10.0 WIRING DIAGRAMS

While this board supports only TTL +5VDC signals, different kind of sensors, switches using different voltages can be connected using the diagrams that follow:

Note: The below wiring diagrams are an example, any input can be used for the connections.

10.1 Connecting Switches or push button.

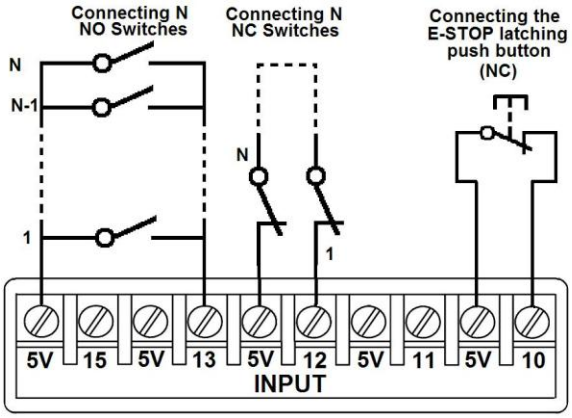


Fig. 6 Wiring diagram to connect switches.

10.2 Connecting NPN sensors.

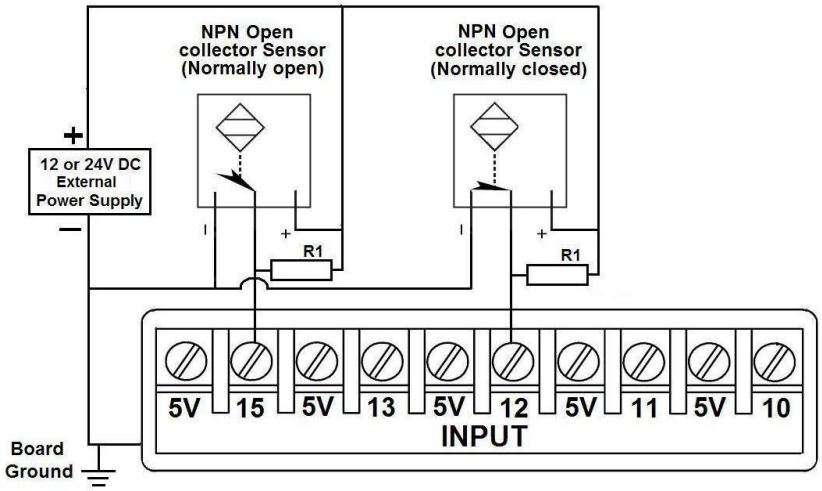


Fig. 7 Wiring diagram to connect NPN open collector proximity sensors.

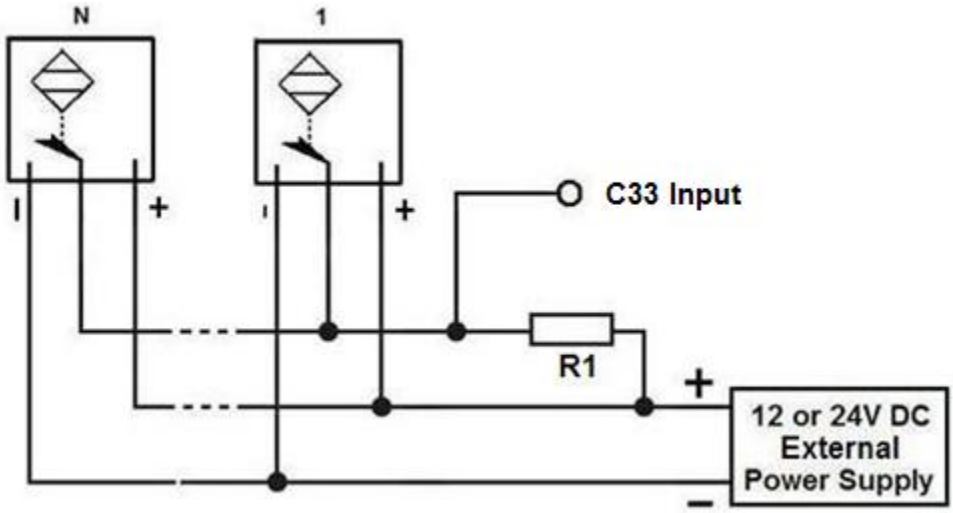


Fig. 8 Wiring diagram to connect in parallel NPN open collector proximity sensors.

Connecting NPN open collector proximity sensor with the C33	
R1 Value (12V)	**R1 Value (24V)**
Aprox. 10KΩ	Aprox. 25KΩ

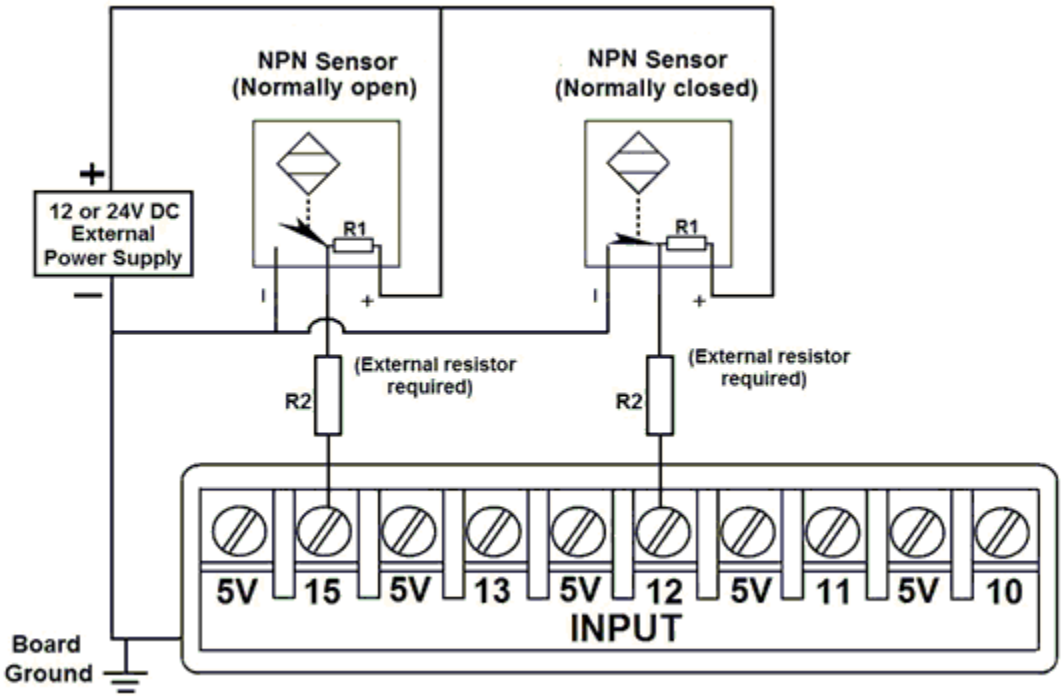


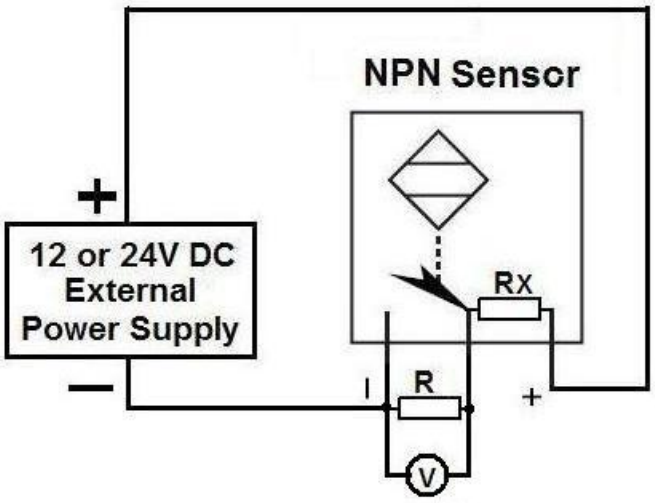
Fig. 9 Wiring diagram to connect NPN proximity sensors with internal pull up resistor.

Some NPN proximity sensor has a pull-up resistor (R1) internally. It is necessary to know its value in order to connect safely the sensor with the BOB. Follow this recommendation:

Connecting NPN open collector proximity sensor with the C33	
(R1+R2) Value (12V)	**(R1+R2) Value (24V)**
Aprox. 10KΩ	Aprox. 25KΩ

Calculating the R1 value

Note: Rx is the unknown resistor value.



$$R_X = V_{EX}.(R/V) - R \quad (1)$$

Where:
V_{EX} is the external power supply voltage
V is the voltage across the R resistor

An external resistor and a voltmeter are required to calculate the internal resistor (Rx) value.
Note. The user should know the R value to do this operation. A 4.7KOhm @ 1/2W is recommended.
SAMPLE: if you are using a 12V power supply (V_{EX}), and using a 4.7KOhm as external resistor (R), then the voltage across R should be 6V, using the equation 1, the Rx value is 4.7KOhm.

10.3 Connecting PNP sensors.

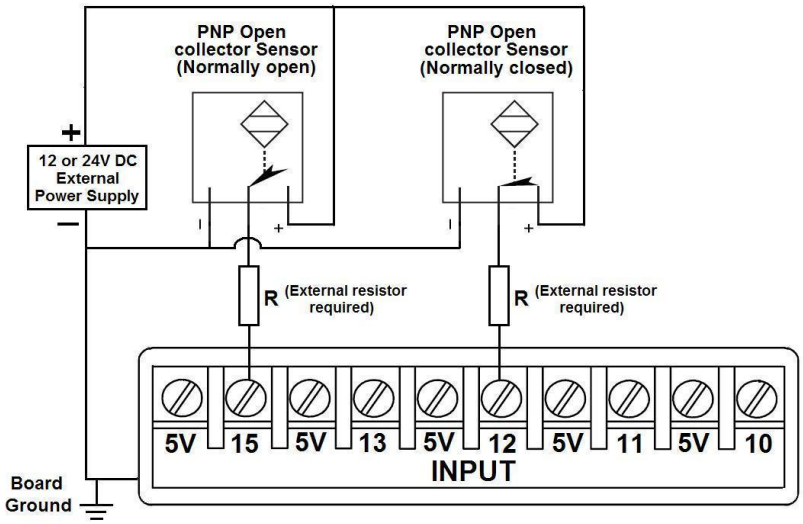

PNP Open collector Sensor (Normally open)
PNP Open collector Sensor (Normally closed)
12 or 24V DC External Power Supply
+
−
R (External resistor required)
R (External resistor required)
5V 15 5V 13 5V 12 5V 11 5V 10
INPUT
Board Ground

Fig. 10 Wiring diagram to connect PNP proximity sensors

Connecting PNP proximity sensor with the C33	
R Value (12V)	**R Value (24V)**
Aprox. 10KΩ	Aprox. 25KΩ

10.4 Other connection.

Other connections can be implemented by setting the inputs to pull-up resistor.

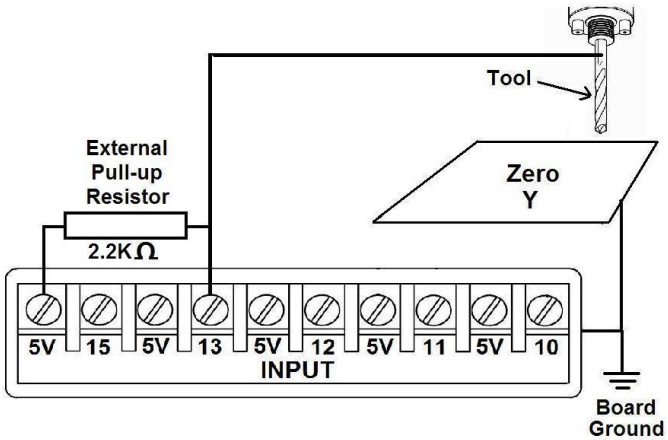


Fig. 11 Wiring diagram to do an "Auto Tool Zero"

11.0 TROUBLESHOOTING

SYMPTOM 1: THE BOARD. **Other connections can be implemented by setting the inputs to pull-up resistor.**
NOT RELAY THE SIGNALS.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **Pin conflict or mach3 configuration**. It is possible that the port address used for the pin is not right, or that there is a pin conflict with the. That is that you are using that same pin twice. (It could be assigned to a different function).	- Go to the device manager in windows, and check the memory address used for the parallel port you are using. Usually it will be 378 for LPT1. Check also that the port does not have a conflict. Then in mach3, go to Ports & Pins / Port Setup and Axis Selection. Check the memory address is correct. - Check that the pin you are using is not been used anywhere else in your setup. Got to motor output and output signals, and check all the entries.
- **The board does not like the waveform it is getting.** Some breakout boards could invert the signals or modify the pulse width. Changing the active low status of the pin used also inverts the waveform.	- Play with the active low status of the pin used for the frequency.
- **The signal or frequencies are not getting to the board.** It could be the cable or that you are passing the signal through the same breakout board that you are enabling/disabling, so the outputs could be disabled, so they will not get to the breakout board.	- Try a different cable. - Test the pins in the cable (before they reach the breakout board) with a multimeter.
- **Problems with Mach3 Pulse Generation.** Mach3 could have installation problems (you did not restart immediately after installation), or there could be something creating a conflict. Some dongle devices might cause this, other software, like QuickTime or drivers for touch screen.	- Test this in a different PC. - Follow Art's suggestions for optimizing up WinXP: http://www.machsupport.com/downloads/XP_Optimization.txt.

SYMPTOM 2: THE OUTPUTS DO NOT GET ENABLED / NO SIGNALS ARE COMING OUT.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **The EN terminal (Enable Outputs) is not enabled.** The board requires to be externally enabled. - **The parallel cable is not well connected to the PC parallel port.**	- Make sure you are providing +5vdc to the EN terminal. This +5vdc can be taken from the terminal next to it. - Check if the parallel port is well connected to the PC.

SYMPTOM 3: THERE IS NOISE IN THE SYSTEM, OR THE MOTORS DO NOT MOVE SMOOTHLY.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **The board could be underpowered.**	- Make sure you are using a +5vdc 500mA power supply.
- **There could be a short that could be draining the power to the board.**	- Check that there are no hot spots in the board or it's connections. - Measure the board's power consumption, it should be less than 400mA (depending on the features used). - Blown chips could create an internal short and end up drawing power that can affect how other chips work.
- **There could be an external noise source that could be introducing noise into the system.**	- Try using shielded cables. - Try to isolate VFDs or AC servos, etc. - Try using 103. 0.1mF caps between the I/O terminal and a ground of the board.

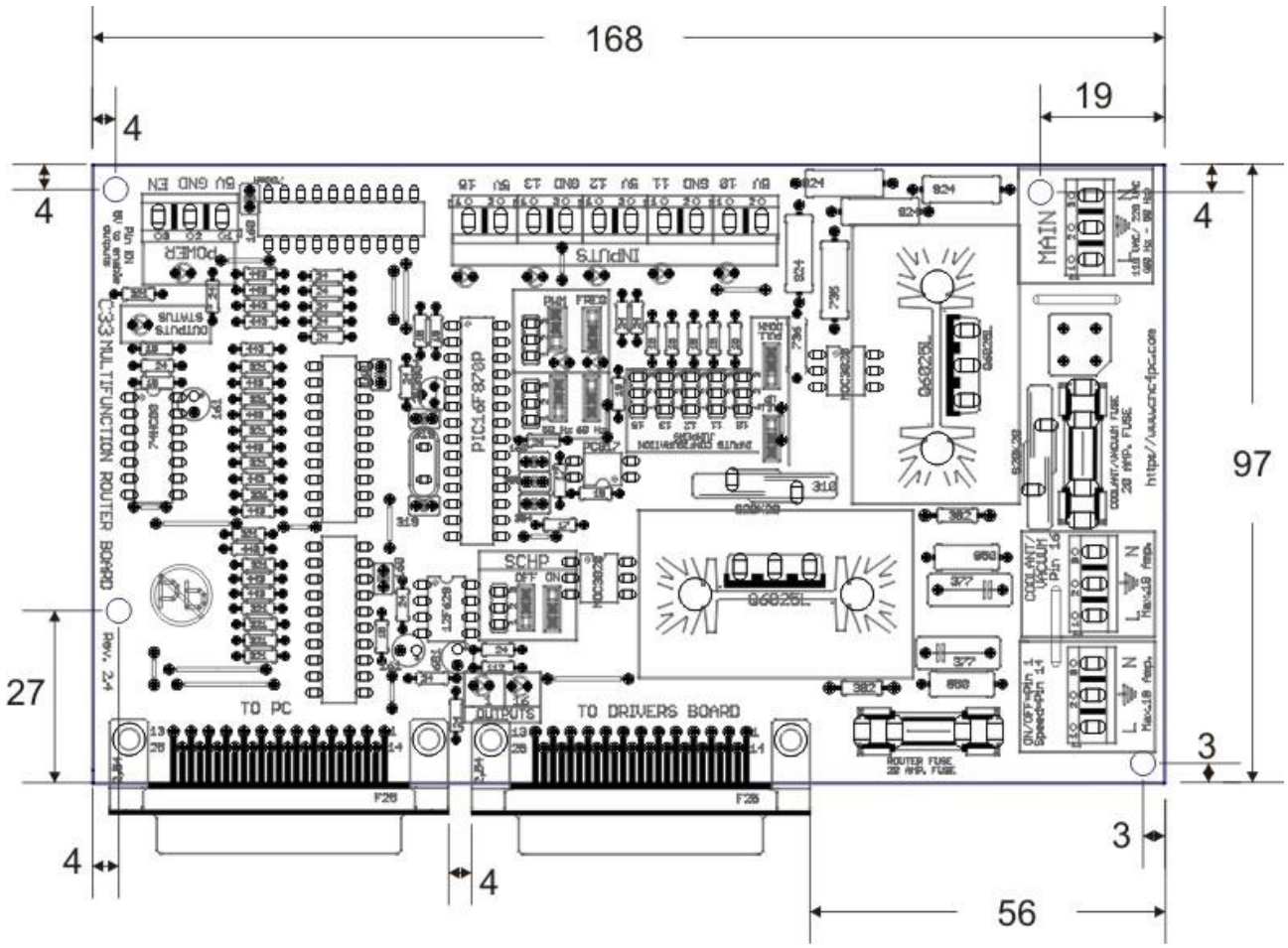
SYMPTOM 5: A I/O PIN MIGHT NOT BE WORKING.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **A chip may have gone bad.** These buffers could act as fuses for the signals, and they can go bad because of noise spikes or even strong static.	- These chips are inexpensive and readily available. You can order them here: http://www.cnc4pc.com/Store/osc/index.php?cPath=38_43. - Carefully moving chips around and checking if the problem moves around could be a way of figuring out if this is the case.
- **There could be a problem with the parallel cable or parallel port.**	- Test this with a different PC or parallel port.

SYMPTOM 5: MOTOR DOES NOT START.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **Router does not start.**	- Make sure you are connecting the AC source to the C33 Main Terminals. - In Mach *X*, go to Config / Ports&Pins / Motor Outputs. Change the active low status of the pin 14 - Check the onboard fuses. - In Mach *X*, go to Config / Ports&Pins / Motor Outputs. Change the active low status of the pin 1.
-	-

12.0 DIMENSIONS



All dimensions are in Millimeters.

DISCLAIMER

Use caution. CNC machines can be dangerous machines. Neither DUNCAN USA, LLC nor Arturo Duncan are liable for any accidents resulting from the improper use of these devices. This product is not a fail-safe device and it should not be used in life support systems or in other devices where its failure or possible erratic operation could cause property damage, bodily injury or loss of life.